

06-26-00

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**UTILITY PATENT APPLICATION TRANSMITTAL  
(Large Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.  
A-366

Total Pages in this Submission

**TO THE ASSISTANT COMMISSIONER FOR PATENTS**Box Patent Application  
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for invention entitled:

**METHOD FOR CORRECTING DEFECTS ON COLOR FILTER**

and invented by:

Shigeyasu NAKAZAWA et al

If a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.:

Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.:

Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.:

Enclosed are:

**Application Elements**

1. ☐ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 16 (sixteen) pages and including the following:
  - a. ☒ Descriptive Title of the Invention
  - b. ☐ Cross References to Related Applications (if applicable)
  - c. ☐ Statement Regarding Federally-sponsored Research/Development (if applicable)
  - d. ☐ Reference to Microfiche Appendix (if applicable)
  - e. ☒ Background of the Invention
  - f. ☒ Brief Summary of the Invention
  - g. ☒ Brief Description of the Drawings (if drawings filed)
  - h. ☒ Detailed Description
  - i. ☒ Claim(s) as Classified Below
  - j. ☒ Abstract of the Disclosure

**UTILITY PATENT APPLICATION TRANSMITTAL**  
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**Application Elements (Continued)**

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
- a. ☒ Formal Number of Sheets 4 (four)
- b. ☐ Informal Number of Sheets \_\_\_\_\_
4. ☒ Oath or Declaration
- a. ☒ Newly executed *(original or copy)* ☐ Unexecuted
- b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
- c. ☒ With Power of Attorney ☐ Without Power of Attorney
- d. ☐ DELETION OF INVENTOR(S)  
Signed statement attached deleting inventor(s) named in the prior application,  
see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*  
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied  
under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby  
incorporated by reference therein.
6. ☐ Computer Program in Microfiche *(Appendix)*
7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
- a. ☐ Paper Copy
- b. ☐ Computer Readable Copy *(identical to computer copy)*
- c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

**Accompanying Application Parts**

8. ☒ Assignment Papers *(cover sheet & document(s))*
9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
10. ☐ English Translation Document *(if applicable)*
11. ☐ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Acknowledgment postcard
14. ☒ Certificate of Mailing
- ☐ First Class ☒ Express Mail *(Specify Label No.):* EL485835579US

# UTILITY PATENT APPLICATION TRANSMITTAL (Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.  
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Total Pages in this Submission

## Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☒ Additional Enclosures (please identify below):

Inventor Information Sheet (Patent Bibliographical Data)

## Fee Calculation and Transmittal

### CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	5	- 20 =	0	x \$18.00	\$0.00
Indep. Claims	2	- 3 =	0	x \$78.00	\$0.00
Multiple Dependent Claims (check if applicable) <input checked="" type="checkbox"/>					\$260.00
BASIC FEE					\$760.00
OTHER FEE (specify purpose) Assignment Recordation Fee					\$40.00
TOTAL FILING FEE					\$1,060.00

- ☒ A check in the amount of \$40.00 to cover the filing fee is enclosed.
- ☐ The Commissioner is hereby authorized to charge and credit Deposit Account No. as described below. A duplicate copy of this sheet is enclosed.
- ☐ Charge the amount of as filing fee.
- ☐ Credit any overpayment.
- ☐ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance pursuant to 37 C.F.R. 1.311(b).

*James H. Walters*  
Signature  
James H. Walters, Reg. No. 35,731  
DELLETT AND WALTERS  
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Dated: June 23, 2000

CC:

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CORRESPONDENCE INFORMATION

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APPLICATION INFORMATION

Title Line One:: METHOD FOR CORRECTING DEFECTS ON COLOR F  
Title Line Two:: FILTER  
Total Drawing Sheets:: 4  
Formal Drawings?:: Yes  
Application Type:: Utility  
Docket Number:: A-366  
Secrecy Order in Parent Appl.?:: No

REPRESENTATIVE INFORMATION

Representative Customer Number:: 802  
Registration Number One:: 35731

PRIOR FOREIGN APPLICATIONS

Foreign Application One:: 11-179232  
Filing Date:: 06-25-1999  
Country:: JAPAN  
Priority Claimed:: Yes  
Foreign Application Two:: 2000-159793  
Filing Date:: 05-30-2000

Express Mail #EL485835579 US

Country:: JAPAN

Priority Claimed:: Yes

Source:: PrintEFS Version 1.0

00000000.00000000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Shigeyasu NAKAZAWA et al

S. N.

Filed:

For: METHOD FOR CORRECTING DEFECTS ON COLOR FILTER

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Please make the following amendments to this application  
prior to examination thereof:

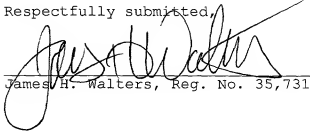
In the Specification:

Page 5, line 9, delete "Fig. 3 represents" and substitute  
--Figs. 3 (A) — 3 (C) represent--;  
line 11, delete "Fig. 4 represents" and substitute  
--Figs. 4 (A) — 4 (D) represent--;  
line 13, delete "Fig. 5 represents" and substitute  
--Figs. 5 (A) — 5 (C) represent--.

REMARKS

The above amendments are submitted to place the  
application into a format consistent with U.S. practice.

Respectfully submitted,

  
James H. Walters, Reg. No. 35,731

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## METHOD FOR CORRECTING DEFECTS ON COLOR FILTER

### BACKGROUND OF THE INVENTION

The present invention relates to a method for  
5 correcting protruding defects or white or black defects on  
a color filter, which occur during a process to manufacture  
a color filter for liquid crystal display apparatus.

Referring to Fig. 6, description will be given below  
on an example of a method for manufacturing a color filter.  
10 On a transparent substrate 2 such as a glass plate, a  
light-shielding layer BM comprising striped pattern with  
line width of 20  $\mu\text{m}$ , pitch of 80  $\mu\text{m}$ , and film thickness of  
about 0.5  $\mu\text{m}$  is formed by screen printing. Next, on the  
light-shielding layer, a red colorant sensitive material R  
15 is coated. Then, a photo mask is placed and light  
exposure is performed. Next, a green pattern layer and a  
blue pattern layer are formed by the same procedure. Both  
longitudinal sides of each color pattern layer are  
overlapped on the light-shielding layer BM for a length of  
20 about 10  $\mu\text{m}$ , and the film thickness is about 2  $\mu\text{m}$ . Next,  
with the purpose of achieving physico-chemical protection,  
and of evenly adjusting and flattening the surface, a  
photo-curing resin is coated on the color pattern layer,  
and a protective film layer OP is formed in film thickness  
25 of about 2 - 3  $\mu\text{m}$ . Further, a film of indium tin oxide  
(ITO) is formed on the protective layer by vacuum film  
forming method, and electrode pattern is fabricated by mask  
deposition method, etching method, etc., and a transparent

electrode layer is formed to prepare a color filter.

In the process to manufacture the color filter as described above, foreign objects "a" such as dust are intermingled in the coating process to coat color sensitive material as shown in Fig. 6. If these objects remain on the color pattern layers R, G or B or foreign objects such as dust are attached on the surface of the color pattern layer, protruding defects "b" may be formed on the portions corresponding to the foreign objects such as dust when the protective layer OF is formed on the color pattern layer. Also, when dust is attached on the photomask, white defects "c" may occur on the color pattern layer or black defects may be generated on the light-shielding layer BM. Such defects may impair orientation of liquid crystals in liquid crystal cells, which are provided on the surface of the color filter, or may lead to defects in the images taken or displayed, and the products produced using the color filter may become defective. In the past, as described in JP-A-3-274504 or JP-A-9-184910, methods have been proposed to coat a colorant sensitive material after cutting the defective portion off and to remove it using the laser beam in order to correct the above defects.

#### SUMMARY OF THE INVENTION

However, according to the conventional method for correcting defects as described above, it is difficult to fill ink to corners when the corrective ink is dropped to the upper surface because almost the entire region of



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picture element is cut in rectangular shape, and void patches or unevenly colored portions are likely to occur. Also, the quantity of the colorant to be removed is higher than the case when only the portion near the defects are  
5 out off. As a result, colorant materials are splashed to the surrounding regions, and these may cause new defects. Further, in case the hue of the corrective ink is different by approximately one picture element from the hue of colorant picture element, defects are very likely to occur  
10 due to color difference. As a result, the percentage of acceptable products after correction may be low.

To solve the above problems, it is an object of the present invention to provide a method for correcting defects on a color filter, by which it is possible to  
15 correct all of protruding defects, white defects and black defects, which are generated in the process to manufacture color filter and to extensively improve the percentage of high quality products.

To attain the above object, the invention of claim 1  
20 provides a method for correcting defects on a color filter, which comprises the steps of setting a diameter of a laser beam in a circular correcting region including defective portion, or more preferably, in a circular correcting region comprising a circle which circumscribes the  
25 defective portion in order to ensure better permeation of liquid and better diffusion, and to prevent uneven coloring due to insufficient flow of the liquid when the defective portion on the color filter is removed by irradiation of



coloring.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram to explain an example of a  
5 method for correcting defects on a color filter according  
to the present invention;

Fig. 2 is a drawing to explain setting of a diameter  
of laser beam in the arrangement shown in Fig. 1;

Fig. 3 represents drawings to explain Example 1 shown  
10 in Fig. 1;

Fig. 4 represents drawings to explain Example 2 shown  
in Fig. 1;

Fig. 5 represents drawings to explain a comparative  
example shown in Fig. 1; and

15 Fig. 6 is an enlarged sectional view to explain a  
defect on a color filter.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Description will be given below on embodiments of the  
20 present invention referring to the drawings. Fig. 1 is a  
block diagram to explain an example of a method for  
correcting defects on a color filter according to the  
present invention.

In Fig. 1, a substrate 2, which has a color pattern  
25 layer as described above formed on it, is placed on an XY $\theta$   
stage (substrate moving stage) 1. This XY $\theta$  stage can be  
moved along XY plane and at a tilt angle  $\theta$  by a driving  
mechanism 3. A defect detecting unit 4 is a device for



correcting region M, which comprises a circle  
circumscribing the defective portion D, and its center is  
used as a position information of the defective portion D.  
The circular correcting region M may be a circle, which  
5 includes the defective portion D. The diameter "r" can be  
changed within the range of 50 to 150  $\mu$ m. After the  
diameter of the laser beam has been adjusted to a desired  
value by the opening adjuster 17, the laser beam is  
protruding to the substrate 2 positioned on the XY $\theta$  stage  
10 1 via a mirror 19, an image forming lens 20, the  
semitransparent mirror 7 and the objective lens 6.

A defect correcting unit 21 is a device to place and  
fill a pattern layer into a portion, from where the  
substances have been removed by the laser irradiating unit  
15 12, and it is provided with an ink discharge unit 22, a  
driving circuit 23 for driving the ink discharge unit and  
an ink hardener 24. As the ink discharge unit 22, a  
dispenser or an ink jet device may be used. As the method  
for discharging from the dispenser, a continuous discharge  
20 method for continuously discharging the ink or an  
intermittent discharge method for intermittently  
discharging the ink after ink drops are prepared may be  
used. As the ink jet unit, there are two types:  
continuous type and on-demand type. The former is to  
25 apply an electric field while ink is continuously injected,  
and ink is collected on a capture dish so that ink is not  
coated on the substrate of the color filter. According to  
the latter, the color filter substrate is moved, and ink

discharge is turned on or off, depending on the position of the substrate. As the ink discharge unit 22 as described above, it is preferable to use an ink jet unit. Other methods are that corrective inks can also be dropped by laser thermo-fusible transfer method, needle painting method, and so on. In the following, description will be given by taking an example on the ink jet unit.

The ink jet unit 22 is a device to drop corrective ink in four colors of red, green, blue and black. The corrective ink is preferably an ink made of thermo-curing resin or UV-curing resin with higher surface tension. The ink hardener 24 comprises a heating block or a UV-irradiation spot light source. It is designed in such manner that the ink jet unit 22 and the ink hardener 24 can be moved toward the substrate 2 by a lift mechanism (not shown).

The arithmetic unit 11 transmits an information, which indicates shape of the defective portion and its position to the driving mechanism 18, and drives the opening adjuster 17 to change the diameter of the laser beam. At the same time, it drives the XYθ stage 1 and determines irradiating position of the laser beam. Also, it transmits signals to the UV laser oscillator 13 and the density adjuster 14 and controls irradiation time, number or times of irradiation, and irradiation energy density. Signals of ink color and ink drop quantity are sent to the driving circuit 23, and the ink jet unit 22 is controlled.

Next, description will be given on Examples 1 and 2

and comparative example of this embodiment. First, Example 1 will be described referring to Fig. 3.

Fig. 3 (A) shows a condition where the circular correcting region M including the defective portion of a green pattern layer G is removed by the laser beam. In this example, line width of a light-shielding layer BM is 20  $\mu$ m, BM spacing is 80  $\mu$ m, film thickness of a colored layer RGB is 1.4  $\mu$ m, and diameter of the circular correcting region M is 55  $\mu$ m. Next, green corrective ink G' is dropped to the circular correcting region M by the ink jet unit 22 as shown in Fig. 3 (B). As the green corrective ink G', thermo-curing resin or UV-curing resin is used.

● The following materials were used as the thermo-curing resin:

Binder resin: Copolymer of benzyl methacrylate and glycidyl methacrylate

Multifunctional epoxy resin:

Cresol novolak type epoxy resin

Polyvalent carboxylic acid: Trimellitic acid

Solvent: Propylene glycol monomethylether acetate

G pigment: C.I.No. Pigment Green 36

Y pigment: C.I.No. Pigment Yellow 150

Dispersant: Solsperse 24000 (manufactured by Avicia)

● A pigment dispersion composition having the following components was used as UV-curing resin:

Binder resin: Copolymer of methacrylic acid and  
benzyl methacrylate

Multifunctional monomer:

Trimethylolpropane triacrylate

5 Photopolymerization initiator:

Irgacure 907 (manufactured by Ciba  
Specialty Chemicals)

Solvent: Ethoxyethyl propionate

G pigment: C.I.No. Pigment Green 36

10 Y pigment: C.I.No. Pigment Yellow 150

Dispersant: Solsperse 24000 (manufactured by  
Avicia)

Discharge quantity (volume) of this ink was 4 drops at  
the rate of 20 FI/drop. That is, ink drops of 80 FI were  
15 dropped so that the ink is formed in spherical shape on  
upper surface of the circular correcting region (Fig. 3  
(B)). Finally, when the corrective ink G' was hardened  
using the ink hardener 24, the corrective ink G' was shrunk  
as shown in Fig. 3 (C), and the circular correcting region  
20 M was filled and corrected to be flush. Thus, it is  
possible to equalize variation in film thickness to 0.1  $\mu\text{m}$ ,  
and unevenness of color can also be corrected almost to the  
level suitable for practical use.

In case of thermo-curing resin, when the corrective  
25 ink G' is hardened, baking was performed at 220°C for 10  
minutes on the heating block. By this heating, the  
spherically swollen form of ink by 5  $\mu\text{m}$  higher than the  
upper surface of the surrounding portion after ink dropping



was reduced to a form of a concave lens by  $0.05\mu\text{m}$  lower than the upper surface of the surrounding portion. In case of UV-curing resin, ultraviolet ray was irradiated by spot irradiation of  $1000\text{ mJ/cm}^2$ , and baking was performed

5 at  $200^\circ\text{C}$  for 30 minutes on the heating block. By this heating, the spherically swollen form of ink by  $5\mu\text{m}$  higher than the upper surface of the surrounding portion was turned to a form of a convex lens which was by  $0.09\mu\text{m}$  higher than the upper surface of the surrounding portion.

10 Next, Example 2 will be described referring to Fig. 4. Fig. 4 (A) shows a red pattern layer R. A protruding defective portion D is present where the size of picture element is  $100 \times 300\mu\text{m}$ , and film thickness is  $1\mu\text{m}$ . Fig. 4 (B) shows a condition where the circular correcting

15 region M including the defective portion D is removed by the laser beam. Diameter of the circular correcting region M is  $60\mu\text{m}$ . Next, red corrective ink R' is dropped to the circular correcting region M by the ink jet unit 22 as shown in Fig. 4 (C). As the red corrective ink R',

20 thermo-curing resin is used.

● The following substances were used as the thermo-curing resin:

Binder resin: Copolymer of benzyl methacrylate and glycidyl methacrylate

25 Multifunctional epoxy resin:

Cresol novolak type epoxy resin

Polyvalent carboxylic acid:

Trimellitic acid



the laser beam. The size of the portion to be removed was 100 x 300  $\mu$ m, and this approximately corresponded to one picture element. Next, to the correcting region M' of the portion to be removed, a red corrective ink R' which was  
5 the same corrective ink as in Example 2 was dropped by the same procedure as in Example 2. As shown in Fig. 5 (B), a portion not filled with ink (ink-lacking portion) X was generated at each of four corners of the rectangular correcting region M'. Next, when baking was carried out  
10 by the same procedure as in Example 2, a void portion C or unevenly colored portion C' due to insufficient film thickness was found as shown in Fig. 5 (C).

Next, description will be given on another embodiment of the present invention. In the above embodiment, the  
15 defect correcting unit 21 comprises an ink jet unit 22, a driving circuit 23, and an ink hardener 24. In the present embodiment, however, instead of the defect correcting unit, a device based on the laser CVD method is used, and a metal film of light-shielding film BM, which  
20 has chromium or tungsten as the main components such as Cr(CO)<sub>6</sub>, W(CO)<sub>6</sub>, is deposited by vacuum evaporation in thickness of 1000 angstrom or more. According to this method, similarly to the case of the defect correcting unit 21, the substances in the circular correcting region M  
25 detected by the information transmitted from the arithmetic unit 11 are removed, and the metal film of the light-shielding film BM is deposited on the circular correcting region M. As a result, back light can be completely

shielded. Even when the circular correcting region is a color pattern layer, the metal film of the light-shielding film BM is deposited. No problem occurs in the produced color filter, and not only black defects but also

5 protruding defects or white defects on the color pattern layer can be corrected. When the device based on the laser CVD method is used, the thickness of the metal film to be deposited can be adjusted, and it is possible to form a color pattern layer with no variation in film thickness.

WHAT IS CLAIMED IS:

1. A method for correcting defects on a color filter, comprising the steps of setting a diameter of a laser beam on a circular correcting region including a defective portion when the defective portion of a color filter is removed by irradiation of the laser beam, dropping a corrective ink to upper surface of the circular correcting region by an ink jet unit after the circular correcting region has been removed, and hardening and shrinking the corrective ink by an ink hardener thereafter.

2. A method for correcting defects on a color filter, comprising the steps of setting a diameter of a laser beam on a circular correcting region including a defective portion when the defective portion of a color filter is removed by irradiation of the laser beam, and depositing a metal film by laser CVD method to the circular correcting region after the circular correcting region has been removed.

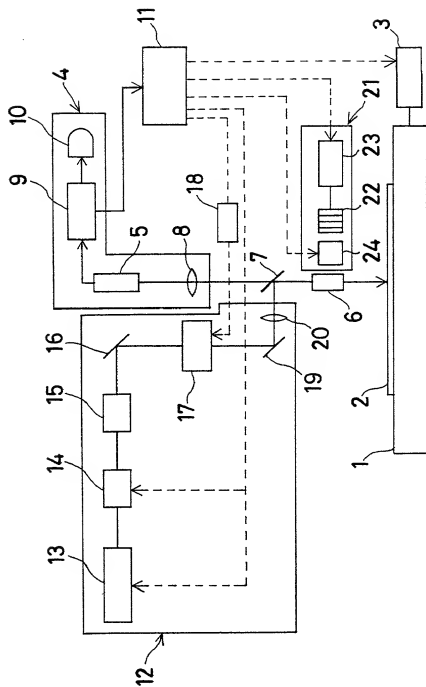
3. A method for correcting defects on a color filter according to claim 2, wherein the metal film to be deposited by the laser CVD method contains chromium or tungsten as main components.

4. A method for correcting defects on a color filter according to claim 2 or 3, wherein the defective portion to be removed by irradiation of the laser beam is a black defect.

ABSTRACT OF THE DISCLOSURE

The present invention provides a method for correcting defects on a color filter with the purpose of correcting defects caused in a process to manufacture the color filter and of extensively improving the percentage of high quality products, and the method comprises the steps of setting a diameter of a laser beam on a circular correcting region M when the defects on the color filter are removed by irradiation of the laser beam, dropping a corrective ink G' to upper surface of the circular correcting region by an ink jet unit after the circular correcting region has been removed, and hardening and shrinking the corrective ink by an ink hardener thereafter.

FIG. 1



A diagram of a cell with a nucleus. The nucleus is labeled 'M' and contains a nucleolus labeled 'D'. The cytoplasm is labeled 'I'.

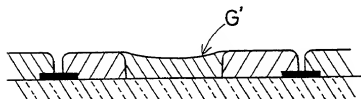
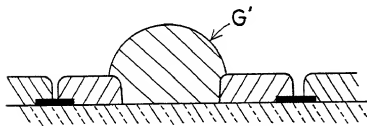
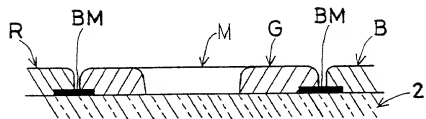






FIG. 5(A)

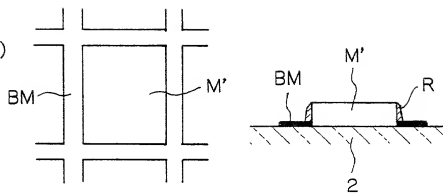


FIG. 5(B)

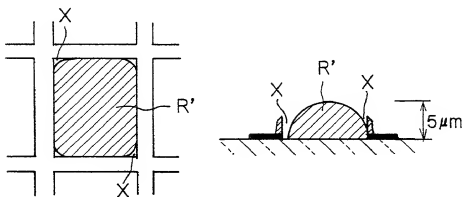


FIG. 5(C)

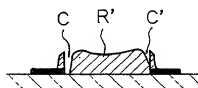
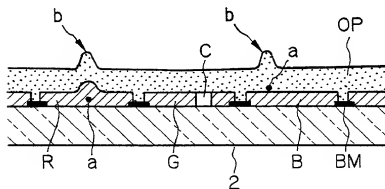


FIG. 6



Attorney's Docket No. A-366

COMBINED DECLARATION AND POWER OF ATTORNEY  
(ORIGINAL APPLICATION)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD FOR CORRECTING DEFECTS ON COLOR FILTER

the specification of which is attached hereto unless box (a) or (b) is checked, in which case

(a) ☐ the specification was filed on \_\_\_\_\_ as Application Serial No. \_\_\_\_\_

(b) ☐ the specification was filed as PCT International Application No. \_\_\_\_\_ filed on \_\_\_\_\_ and was amended under PCT Art. 19 on \_\_\_\_\_ (if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, sec. 1.56.

I have identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America and filed less than 12 months (6 months for designs) prior to this United States application and of which I claim foreign priority benefits under Title 35, United States Code, sec. 119, and I have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

EARLIEST FOREIGN APPLICATION, AND ALL FOREIGN  
APPLICATIONS FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN)  
PRIOR TO THIS U. S. APPLICATION

<u>Country</u>	<u>Application No.</u>	<u>Date of Filing</u> (Month/day/year)
<u>Japan</u>	<u>11-179232</u>	<u>06/25/99</u>
<u>Japan</u>	<u>2000-159793</u>	<u>05/30/00</u>

[illegible]

Send correspondence to:

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Portland, Oregon 97204

(503) 224-0115

I authorize the attorneys that I have appointed to accept instructions regarding this application and the resulting patent from Azusa Patent Office.

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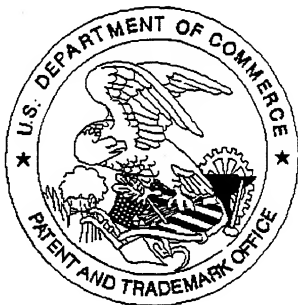
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